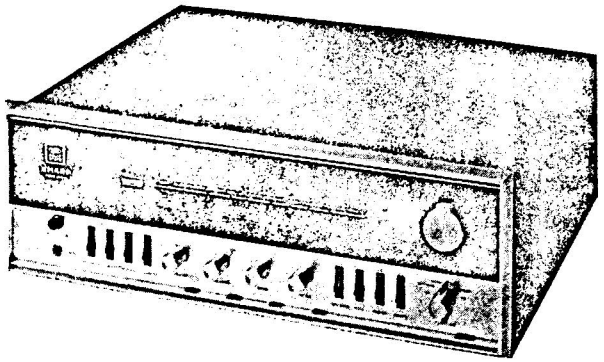
Service Manual



MODEL

STA-31

SPECIFICATIONS

Audio Section

Power Output:	50W total music power (IHFM)
Harmonic Distortion:	1 %
Frequency Response:	15—40,000Hz±1.5dB
Channel Separation:	50dB minimum
Damping Factor:	More than 50
Hum and Noise:	Phono 65dB (IHFM)
	Tape Head 65dB (IHFM)
	Aux. 75dB (IHFM)
Output Impedance:	8 & 16 ohm
High Filter:	10KHz—8dB
Low Filter:	30Hz—8dB
Input Sensitivity (For Rated Output):	
	Phono (MAG) 2 mV
	Phono (X'tal) 130 mV
	Tape Head 1 mV
	AUX 140 mV
Others:	Solid State ITL, OTL output

FM Section

Frequency Range:	88—108 MHz
Sensitivity:	2.0μV±3dB
	1.0μV±3dB
	(for 20dB of quieting)
FM Stereo Separation:	More than 35 dB
FM Stereo Freq. Response:	
	20—15,000Hz ±2.5dB
Others:	AFC, Muting

AM Section

Frequency Range:	530—1605KHz
Sensitivity.:	200μV/m
IF Selectivity:	6 KHz
Antenna:	Built-in ferrite bar antenna

Transistors and Diodes

Transistors:	40
Diodes:	24

Power Equipment:

Power Source:	AC 100/110/120/200/220/ 240V. 50/60Hz
Power Consumption:	100W

HAYAKAWA ELECTRIC CO., LTD.

OSAKA, JAPAN

Transistors

Q1	2SC535(B)	FM RF Amplifire
Q2	2SC535(A)	FM Mixer
Q3	2SC535(B)	FM Oscillator
Q4	2SC460 (B)	FM IF Amplifier
Q5	2SC460 (B)	FM IF Amplifier
Q6	2SC460 (C)	FM IF Amplifier
Q7	2SC380 (O)	AM RF Amplifier
Q8	2SC380(O)	AM Converter
Q9	2SC454 (B)	AM IF Amplifier
Q10	2SC454 (A)	AM IF Amplifier
Q11	2SC281 (B)	FM MPX Composite Amplifier
Q12	2SC281 (B)	FM MPX 19KHz Amplifier
Q13	2SC281 (B)	FM MPX 38KHz Amplifier
Q14	2SC281 (C)	FM MPX Indicator
Q15	2SC281 (C)	FM MPX Indicator
Q16, Q17	2SC369(GR)	Equalizer Amplifier
Q18, Q19, Q20, Q21	2SC373(W)	Equalizer Amplifier
Q22, Q23	2SC369(GR)	Preamplifier
Q24, Q25	2SC373(W)	Preamplifier
Q26, Q27	2SC373(W)	Audio Amplifier
Q28, Q29	2SC734 (O)	Driver Amplifier
Q30, Q31	2SC485 (Y)	Driver Amplifier
Q32, Q33	2SA485 (Y)	Driver Amplifier
Q34, Q35, Q36, Q37	2SD92	Power Amplifier (Matched pairs)
Q38	2SC734 (Y)	Ripple Filter
Q39	2SC281 (C)	Tuning Meter
Q40	2SC281 (C)	Muting

Diodes

D1, D2	1N60 (P)	FM Detector (Matched pair)
D3	1N60	FM AGC
D4	1N60	FM Limiter
D5	1N60	AM Detector
D6	M8513(R)	AM AGC
D7	1N60	Tuning Meter
D8	M8513(R)	Voltage stabilizer
D9	1N34A	FM MPX
D10, D11	1N34A	Frequency Doubler
D12, D13, D14, D15	1N34A	FM MPX Detector
D16	SC15	FM AFC
D17	1S1718	Zener Diode
D18, D19	DS-1P	Rectifier
D20	SD-1Y	Rectifier
D21, D22	SV-02	Thermal Control
D23, D24	M8513	Voltage stabilizer

DISASSEMBLY

1. Bonnet Removal
   1. Remove the 4 screws located on the both sides and 2 screws on the top of the bonnet.
   2. Slightly lift up and remove the bonnet.
2. Cabinet Bottom Removal
   1. Put the set with its bottom up.
   2. Remove the 11 screws fixing the cabinet bottom on the chassis and remove the cabinet bottom.
3. Front Panel Removal
   1. Remove the 6 knobs from the front of the cabinet
   2. Remove the 4 screws fixing the dial panel bracket located on the top and bottom parts of the chassis front.
   3. Slightly pull out the panel holding both sides of it.
   4. There is no need to remove the knob of power switch.

CABINET DISASSEMBLY

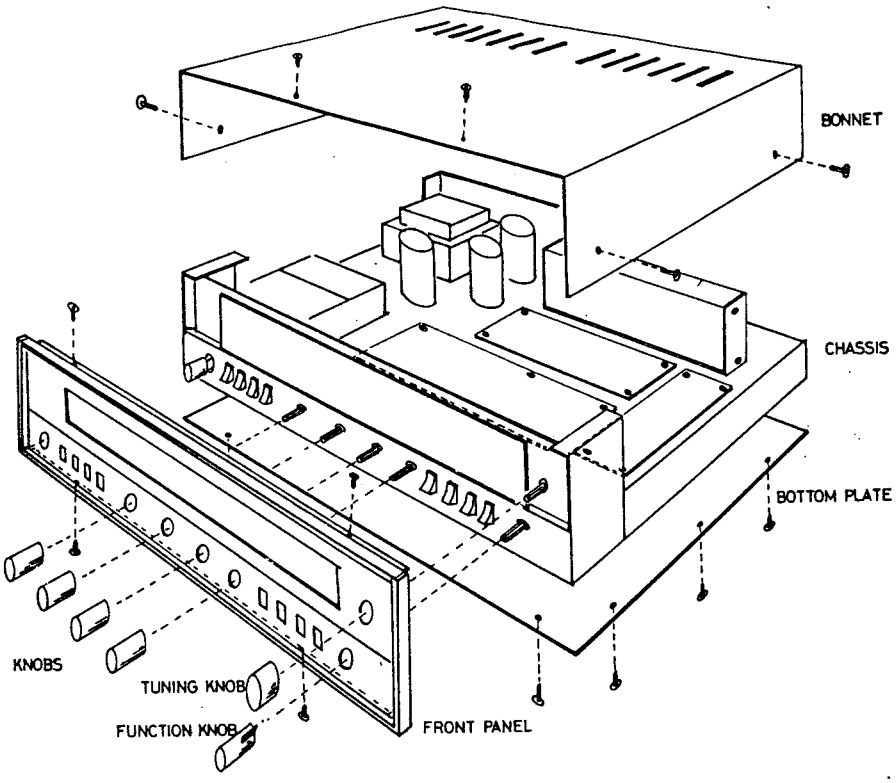


Figure 1

CHASSIS LAYOUT

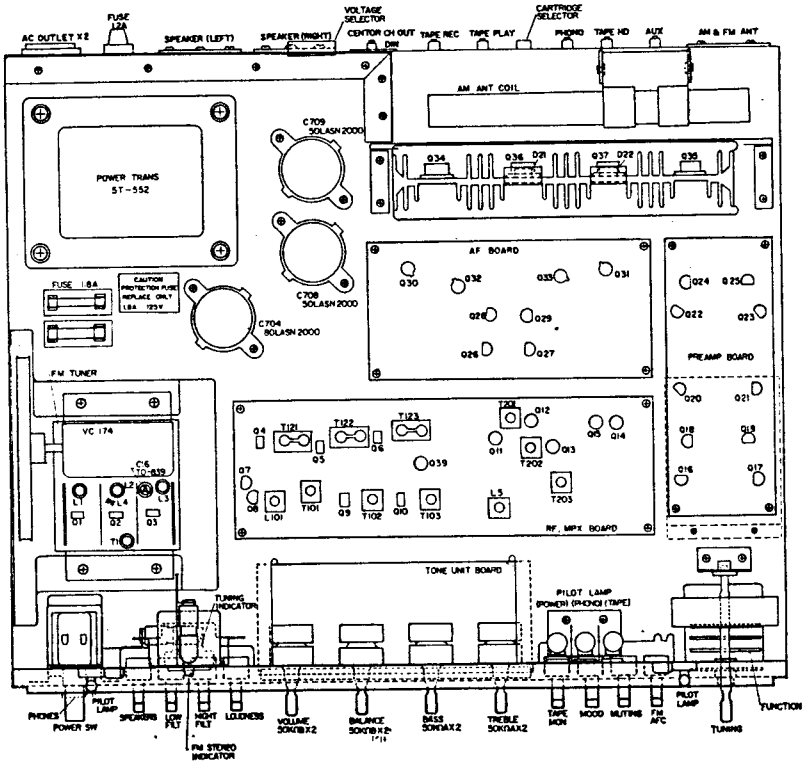


Figure 2

DIAL CORD STRINGING

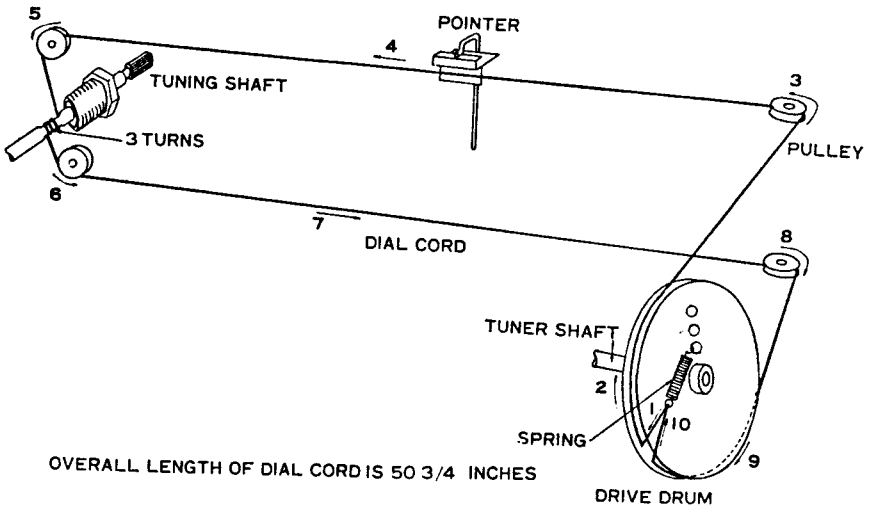


Figure 3

CIRCUIT DESCRIPTION

Model STA-31 is an AM/FM/FM MPX. tuner amplifier. Its circuit construction is shown in the block diagram (Fig. 4).

AM Section

The AM tuner section of this chassis consists of the RF amplifier stage (Q7) with sensitive ferrite bar antenna and conventional converter stage (Q8). The converter utilizes a collector to emitter feedback type oscillator.

Intermediate frequency (455KHz) is first tuned at the primary winding of the IF transformer (T301), which is coupled in series to the oscillator coil (L301) and collector of the converter. The converted 455KHz signal is amplified in the IF amplifier stage (Q9), and in the same way, tuned to the 455KHz signal in the primary winding of the 2nd IF transformer. Then the signal is coupled to the 2nd IF amplifier (Q10). The amplified signal is tuned again to 455KHz in the primary winding of the 3rd IF transformer. This 455KHz AM signal is then detected by the detector diode (D5). At the same time (−) voltage is obtained in the detector output. This voltage is fed to the base of 1st IF amplifier (Q9) through resistor (R317) and to the base of the RF amplifier (Q7) through AGC diode (D6) to assure a double stage AGC effect.

A special silicon diode is used for this AGC diode (D6). Its AGC function is actuated a little later than that of R317. Thus increased AGC performance is ensured under the severest conditions.

FM section

The FM section consists of three parts: front end, IF amplifier and FM detector. The tuner (front end) has a 300 ohm balanced input coil (L1). The signal from this coil is amplified in the RF amplifier stage (Q1). The output of the local oscillator (Q3) passes through the coupling capacitor (C11) and the signal from Q1 are fed to the base of the mixer (Q2).
The collector output is converted to a 10.7 MHz signal and tuned in at transformer (T1). Then it is led to the IF amplifier. The 10.7 MHz signal is amplified in the IF amplifier (Q4). The collector of Q4 is connected to transformer (T101), where limiter diode (D4) damps primary of transformer (T101) at strong signal level.

The signal is tuned to 10.7 MHz again. In the same way as above, this signal is amplified in the 2nd IF amplifier (Q5) and in the 3rd IF amplifier (Q6), which is coupled to the ratio detector transformer. (T103)
The interstage transformers T1, T101, T102 and T103 are all of the double-tuned type. The detector diodes (D1, D2) which is connected to the secondary winding of T103 is of a special pair selection to make the de-

tector action symmetrical. The output of the ratio detector, at test point "E", is divided into AC output and DC output. The former is used to obtain the sound signal and the latter is fed to the AFC diode D16 through resistor (R115, R117 and R13). The switch S10 is the AFC on-off switch. The DC voltage obtained from the primary winding of T103 by the AGC diode (D3) is coupled to the base of the RF amplifier stage Q1 through R1, R3, R118. The stronger the air signal, the higher this voltage becomes. This voltage increase makes the DC operating point of Q1 near cut off.
The gain of Q1 is decreased to make the AGC operation effective. Then the RF stage becomes stable enough to receive a strong air signal such as that near broadcast stations.

FM MPX Section

FM MPX. stereo section consists of the composite signal amplifier stage (Q11), 19KHz pilot signal amplifier stage (Q12), sub-carrier amplifier stage (Q13) and stereo indicator stage (Q14 and Q15).
The output of the FM detector is coupled to the base of the transistor (Q11) through a high frequency compensation circuit C203, R201 and R204 to compensate roll-off characteristics, and to improve stereo channel separation. If the signal is monaural (L+R), it is amplified by the transistor (Q11), which serves two functions: as a 19 KHz amplifier when the 19KHz pilot signal is present and as an ordinary R/C coupled amplifier in the coupling of the monaural signal to the center tap of the 38KHz transformer.

As coil (L202) is tuned to 67 KHz, it will have no effect on the monaural signal. Since this 38 KHz coil (L204) is not grounded, the signals at the top and bottom will be in phase. The 4 demodulator diodes (D12 D13 D14 D15), whose function is disabled by the forward bias voltage obtained from R219, R222 and C217, pass the monaural signal with a minimum of distortion.
Since the signal applied to the disabled diodes is of equal phase and amplitude, the output from each demodulator circuit will be equal, and will represent a complete monaural signal. The FM monaural signal is then fed to the next audio amplifier stage.

If the signal being transmitted is a composite stereo signal, it will include a 19 KHz pilot signal, the sidebands of the modulated 38 KHz suppressed carrier signal (L−R) and a monaural signal (L+R). Transistor (Q11) amplifies the composite FM stereo signal. The coil (L201) is tuned to 19 KHz. A pilot signal is amplified by the transistor (Q11) and coupled to the 19 KHz amplifier (Q12) through the secondary winding. The composite signal is amplified by the transistor (Q11) and extracted from the capacitor C204.
The trap coil (L202) is tuned to 67 KHz which is used as the filter of SCA (Subsidiary Communications Authorization) signal, such as background music or "Storecast". So it must be trapped out to eliminate any possible interference in the FM stereo reception. Consequently, the (L+R) signal (50 Hz—15 KHz), and (L−R) signal which is sidebands of a presuppressed 38 KHz carrier and may range from 23 KHz to 53KHz depending upon the modulating frequency, are coupled to the center tap of the 38 KHz coil (L204) through the capacitor C216.

The 19 KHz pilot signal is thus amplified by the transistors (Q11, Q12) and rectified by two diodes (D10, D11), which double the 19 KHz signal and supply the bias voltage to the 38 KHz doubler (Q13). The current flows through the collector and emitter of Q13. At the same time this current generates across the emitter resistor (R217) a bias voltage which makes the diode (D9) at the emitter of Q12 forward-biased and connects the emitter to the ground through capacitor (C223).

Thus the amplitude gain of Q12 greatly increases. The 38 KHz signal also increases instantaneously at the collector of Q13. At the same time, this voltage neutralizes the forward-bias effect of the 4 detector diodes (D12, D13, D14, D15) and actuates these diodes to operate as a stereo demodulator. We call this circuitry "Automatic FM Mono-Stereo Switching Circuit".

The 38 KHz Coil (L204) is used to reinsert the previously supplessed 38 KHz carrier frequency back into the (L−R) signal.

The 38 KHz reinserted subcarrier appears 180 degrees out of phase at the top and bottom of the secondary winding of coil (L204), when mixed with a composite signal. The right channel modulation appears on the top of the envelope, and the left channel on the bottom. The diodes are connected in such a manner that one series pair detects the top envelope and another series pair detects the bottom, depending on the polarity of the 38 KHz signal. Any 38 KHz carrier, which has passed through the diodes is filtered out in the parallel T filter networks (M201, M202) to improve tape recording characteristics.

The bias voltage across emitter resistor (R217) of transistor (Q13) also actuates the stereo indicator circuitry, and transistor (Q15) which conducts the current through the indicator (PL-201). The transistor Q14

improves this switching action.

In the case of a monaural signal, the output from each demodulator circuit is connected to its respective channel in the audio frequency amplifier stage.

Audio Section

Audio section consists of the equalizer amplifier, pre-amplifier, tone control circuit and power amplifier. The equalizer amplifier is a direct coupling amplifier (coupling Q16, Q18 and Q20) which functions as a flat amplifier for AM, FM and Aux. reproduction as a RIAA equalized amplifier for Magnet or X'tal phono input and as a NAB equalizer amplifier for tape head reproduction.

In either case the rotary switch (S3b) changes the frequency response for corresponding input sources, by conducting the NF which is fed back from the collector of Q20 to the emitter of Q16.

The above is on L channel. The R channel (Q17, Q19, Q21) is identical. The same shall apply hereinafter.

The transistors (Q22 and Q24) are direct coupled amplifiers which have rich NF, and assure improved frequency response wide dynamic range and minimum distortion. The output of collector of Q24 is coupled to the tone control circuit to get the highest desired frequency response.

The output of the tone control circuit is then led to the base of the audio amplifier (Q26) through the coupling capacitor C601. The signal amplified in this stage is fed to the base of the audio driver (Q28) through the coupling capacitor (C603).

The varistor (D21, D23) connected to the collector of (Q28) compensates for thermal deviation in the V_{BE} of Q30, Q32, Q34 and Q36. The varistor (D21, D23), moreover, supply adequate bias voltage to Q30 and Q32. The transistors (Q30) and (Q34) are connected with Darlinton form, and transistors (Q32 and Q36) are with complementary form.

The transistors (Q34 and Q36) function as a power amplifier. They are located on an efficient radiator in order to protect them against excessive heat generated at higher volume operation.

The variable resistor (R641) connected in series with the varistor (D21) is used for adjustment of the bias current of Q34 and Q36 at no signal condition. When replacing the power transistors (Q34 and Q36) readjust the bias current by handling the variable resistor (R641).

The variable resistor (R639) connected in series with the resistor (R617) is adjusted so as to make the collector to ground voltage of Q36 half the value of Q34. The speaker output is took out from the collect of Q36 through the capacitor (C708) while NF voltage is fed back to the emitter of Q26 through the capacitor (C619) and the resistor R635. Another NF voltage fed from the collector of Q36 through the capacitor (C615) and the resistor (R623) improves frequency response, minimizes distortion and assures stable performance.

Tuning Meter Section

D7 rectifies 455 KHz through R325 and C321 at AM reception, and D1 rectifies 10.7 MHz at FM reception and rectified DC+voltage is fed to the base of Q39 to conduct current through tuning meter in proportion to the strength of above IF signals. D8 functions as a voltage stabilizer to ensure stable tuning indication.

Muting Circuit

At FM reception D3 produce DC voltage by rectifying 10.7MHz carrier, and this (−) voltage neutrolizes DC +voltage of Q40 and makes collector impedance of Q 40 greatly increased. Consequently, detected signal is fed through R201 and C202. If no signal is present, detuning noises are all grounded by the very low collector impedance of Q40.

Power Source Section

The power source section can be devided into two parts: output stage power source (51V) and the other power source (30V) for AM section, FM section, etc.

The diodes D18 and D19 rectify 51 volt and supply direct current to the power output stages.

The diode (D20) supplies rectified current to all other sections except power output stages, through the ripple filter which eliminates ripples from the current.

The zener diode (D17) connected to the emitter of Q38 secures uniform voltage supply and provides stable voltage even when highest volume operation.

BLOCK DIAGRAM

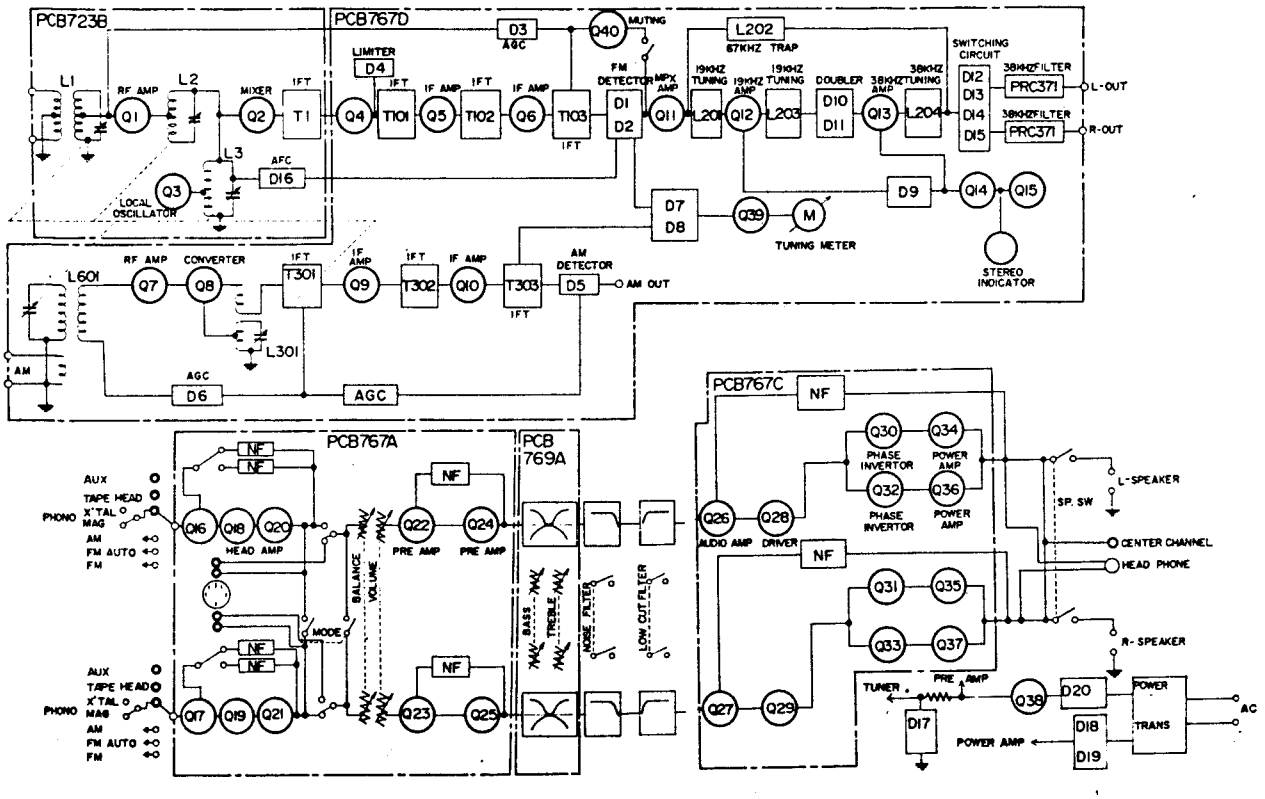


Figure 4

POWER TRANSISTOR REPLACEMENT

The power transistors used in the output stages are matched pairs. They have been selected so that they have very similar current gain and trans-conductance characteristics. This matching is necessary in order to assure optimum performance, but is such that if a transistor fails in either channel, another transistor in that channel must also be replaced. Transistors are supplied only in matched pairs for replacement.

The transistors diffuse a large amount of heat which must be carried off in order to prevent damage to the transistors, the collectors of which are thermally connected to the heat sink by means of electrical insulators to avoid grounding. The insulator is a very thin mica film mounted between the transistor case (collector) and the heat sink.

A layer of silicon grease which is a good conductor of heat is applied to both sides of the insulator in order to improve heat sink operation. When the power transistors are replaced the spacer film must be re-installed and a new layer of grease applied to both sides. Care should be taken, lest conductive dust such as metal particles should break through the insulator films.

RF. MPX BOARD

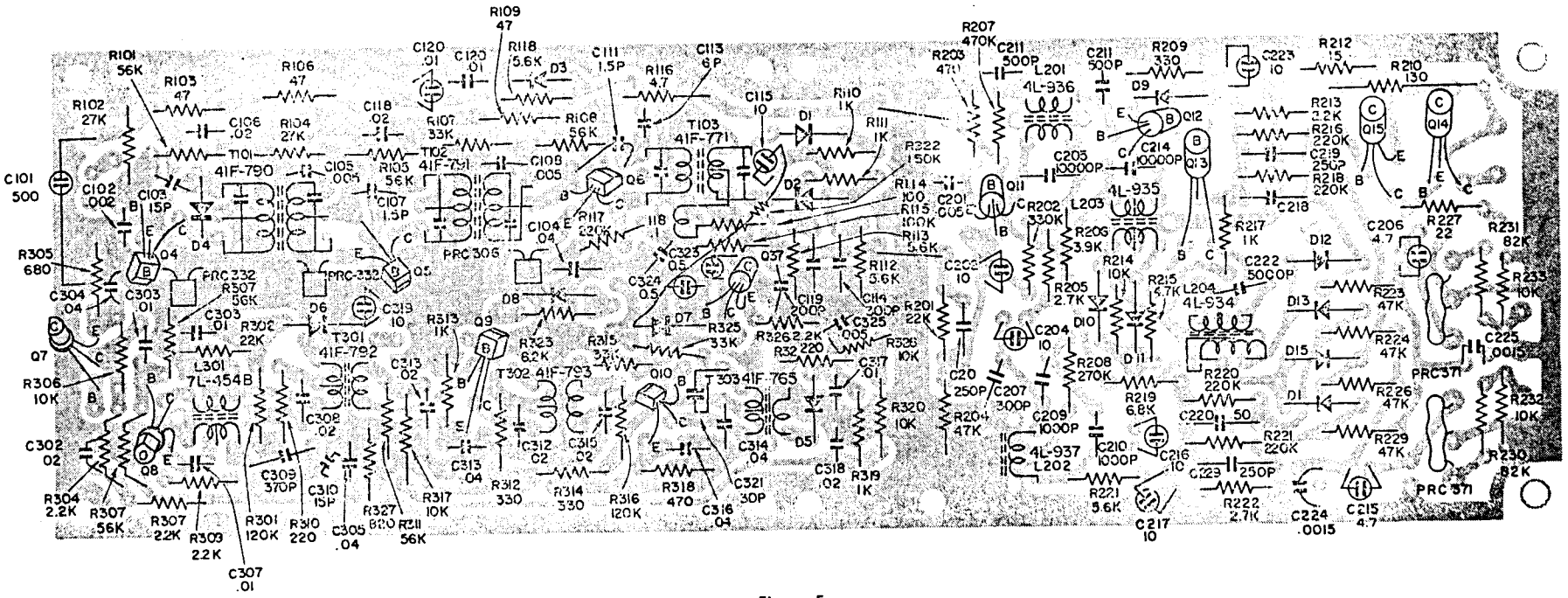


Figure 5

PRE-AMP BOARD

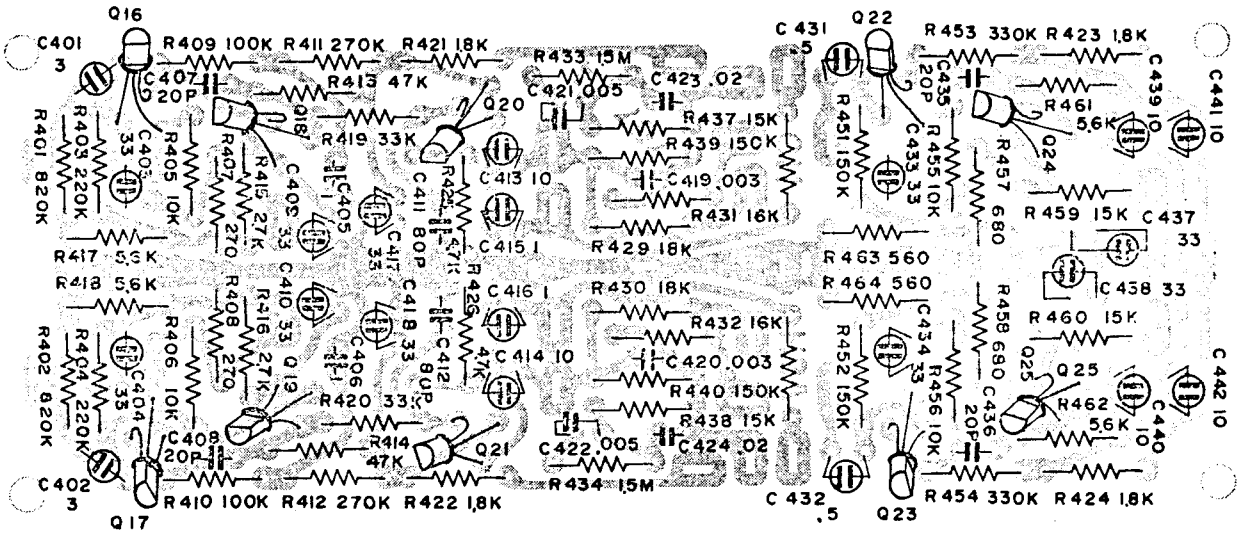


Figure 6

AF BOARD

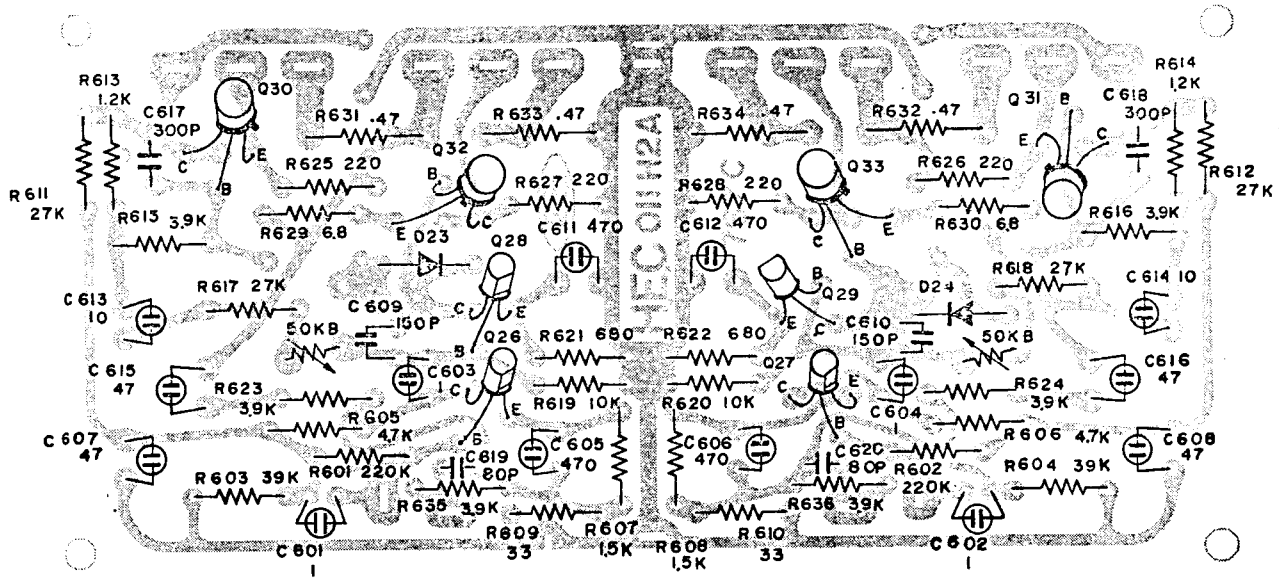


Figure 7

TONE BOARD

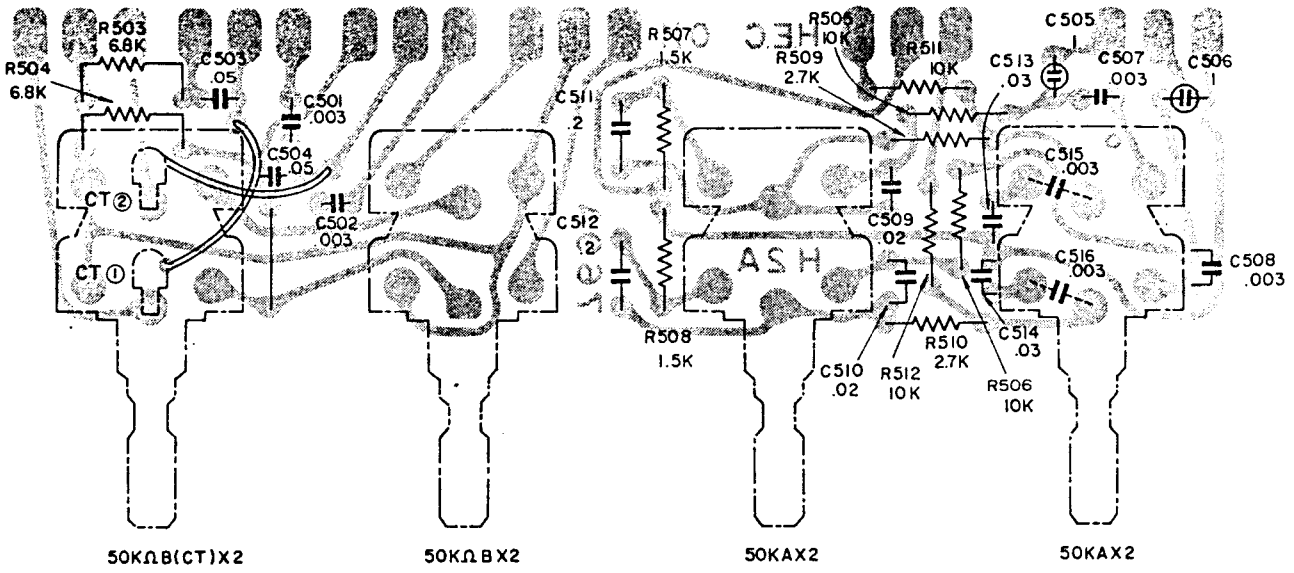


Figure 8

FM TUNER BOARD

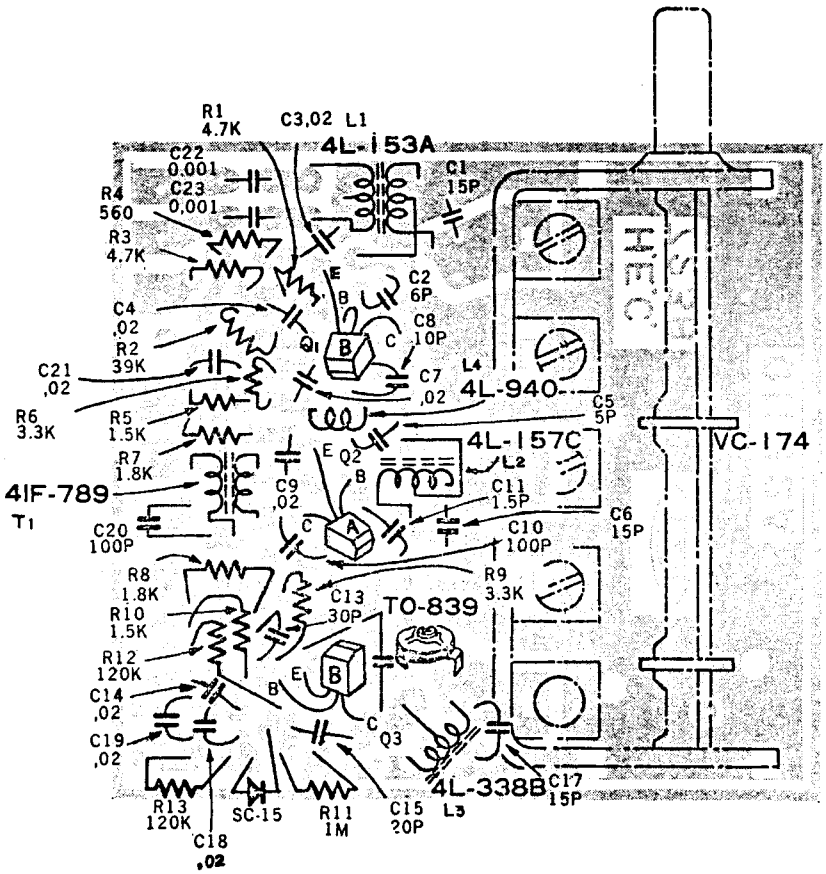


Figure 9

ALIGNMENT INSTRUCTIONS

Alignment is an exacting procedure and should be undertaken only when necessary. If alignment of AM and FM is required, either section may be done first. The FM stereo section, however, should be done only when FM monaural section is sure to be properly adjusted.

Important: Tuner section is of B+grounded type while other sections are of B−grounded type. Do not connect tuner chassis direct currently to the main chassis.

Required Equipments

1. Signal generator with a frequency range of at least 455KHz to 1670KHz: AM
2. Signal generator with a frequency range of at least 86MHz to 108.5MHz: FM
3. Signal generator with a frequency range of at least 10.7MHz ±0.5MHz: FM
4. Vacuum tube voltmeter (AC-VTVM)
5. Sweep signal generator with a sweep range of at least 500KHz and center frequency of 10.7MHz with at least a 10.7MHz marker. (Ext. marker may be used)
6. Oscilloscope with a wide range amplifier of approximately 100KHz
7. Test loop, a coil of any size wire, one turn or more.
8. FM stereo signal generator.
9. Audio signal generator with a frequency range of 20Hz to 100KHz

Notes: Allow the set at least five minutes to warm up before attempting alignment. During alignment keep the signal generator output at the lowest level that will maintain a usable output from the set, except FM stereo signal generator. Take much care, lest the grounding of FM Sweep Signal Generator input should make multipaths which make FM IF alignment incorrect. To avoid this, the grounding lead may be connected through 0.01~0.04 MFD to the tuner chassis when Sweep or SG input is connected to the tuner section.

Ground connection of signal generator ..... chassis ground
Generator modulation (AM) 30%, 400Hz
Generator modulation (FM) 22.5KHz
Generator modulation (FM stereo) ..... Ch. L. or Ch. R 12KHz

AM ALIGNMENT

Signal Generator		Dial Pointer Setting	Selector Setting	Meter Connection	Adjustment	Remarks
Connection	Frequency					
Radiated or TP-9 as small as possible	455 KHz (SG or Sweep)	High end of Dial	AM	Across Output Load	T301(4IF-792) T302(4IF-793) T303(4IF-765) respectively	Volume control max. Get peak output point. Repeat 2 or 3 times.
Radiated Signal as small as possible	515 KHz Modulated	Low end of Dial	AM	Across Output Load	L301(7L-054B)	Same as above.
Radiated Signal as small as possible	1650 KHz Modulated	High end of Dial	AM	Across Output Load	(Oscillator Trimmer)	Same as above.
Radiated Signal as small as possible	1400 KHz Modulated	1400 KHz	AM	Across Output Load	(Tuning Trimmer)	Same as above.
Radiated Signal as small as possible	600 KHz Modulated	600 KHz	AM	Across Output Load	L601(4L-156A)	Same as above.

FM IF ALIGNMENT

Sweep Generator		Dial pointer Setting	Selector Setting	Scope Connection	Adjustment	Remarks
Connection	Frequency					
Thru 0.01 mfd to TP-B	10.7 MHz ±500 KHz	High end of Dial	FM MONO	TP-4	T102(4IF-791)	Maximum amplitude keeping 10.7MHz marker centered
Thru 0.01 mfd to TP-A	10.7 MHz ±500 KHz High Level	High end of Dial	FM MONO	TP-4	T101(4IF-790) Secondary Winding	Same as above.
Thru 0.01 mfd to TP-A	10.7 MHz ±500 KHz as small as possible	High end of Dial	FM MONO	TP-4	T101(41F-790) Primary Winding	Same as above.
Thru 10 pfd to TP-J	10.7 MHz ±500 KHz	High end of Dial	FM MONO	TP-4	T1(4IF-789)	Same as above.
Same as above.	10.7 MHz ±500 KHz	High end of Dial	FM MONO	TP-E	T103(4IF-771)	Adjust for maximum amplitude and symmetry of "S" curve

Note: Before proceeding with FM IF alignment detune primary winding of T103.

FM RF ALIGNMENT

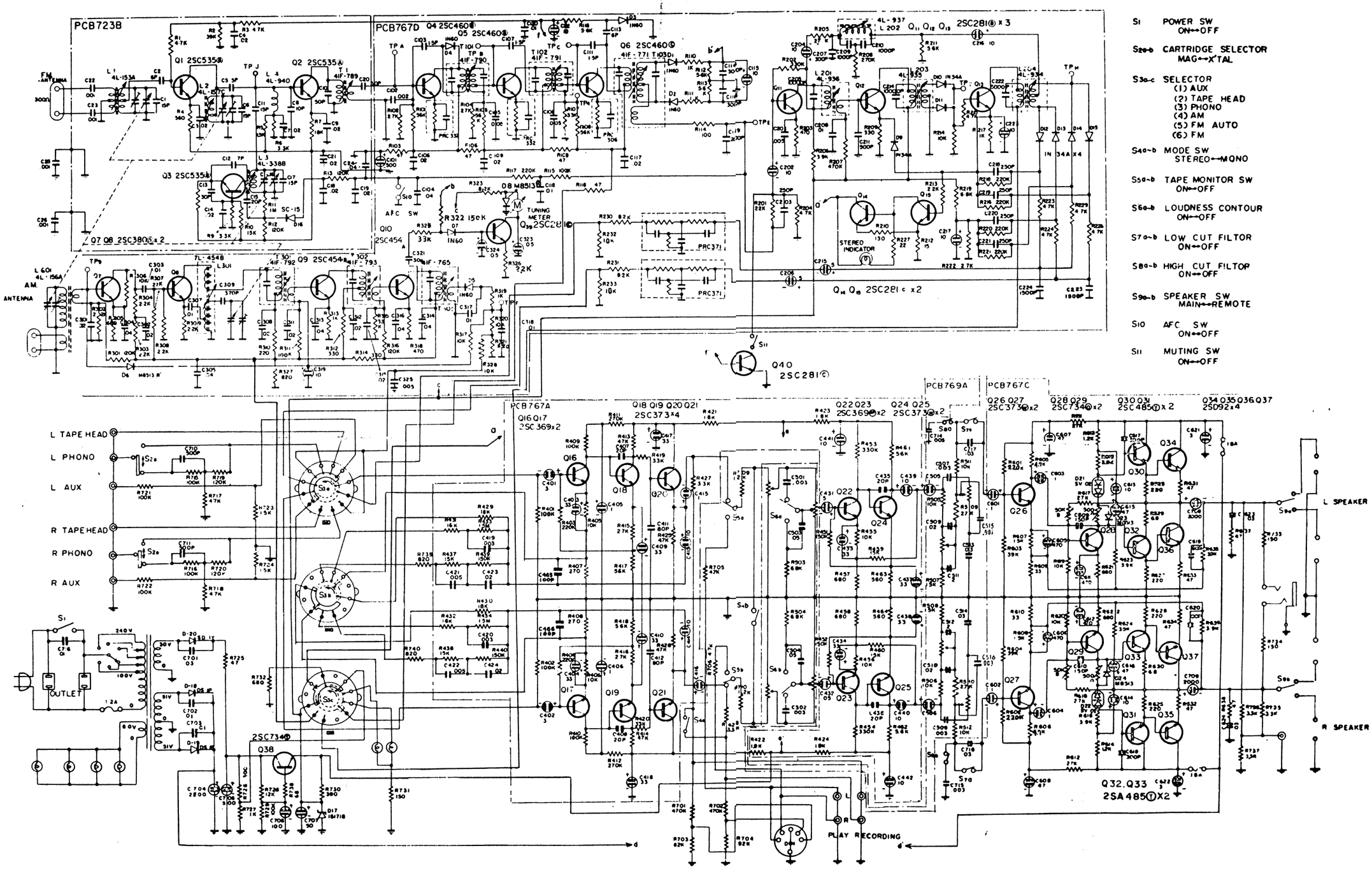
Signal Generator		Dial Pointer Setting	Selector Setting	Meter Connection	Adjustment	Remarks
Connection	Frequency					
FM-ANT Terminal	86.5 MHz Modulated	Low end of Dial	FM MONO	Across Output Load	L3(4L-338B)	Volume Control Max. Get peak output point. Repeat 2 or 3 times.
FM-ANT Terminal	108.5 MHz Modulated	High end of Dial	FM MONO	Across Output Load	C16 (Oscillator Trimmer)	Same as above.
FM-ANT Terminal	90 MHz Modulated	90 MHz	FM MONO	Across Output Load	L2(4L-157C) & L1(4L-153A)	Same as above.
FM-ANT Terminal	106 MHz Modulated	106 MHz	FM MONO	Across Output Load	(Tuning Trimmer)	Same as above.

FM STEREO ALIGNMENT

Signal Generator		Tuning Frequency	Selector Setting	Scope Connection	Adjustment	Remarks
Connection	Mod. Frequency					
FM-ANT	67 KHz 10% Mod.	98 MHz	FM auto	TP-H	L202(4L-937)	Get the minimum point.
FM-ANT	19 KHz Mod. level as small as possible	98 MHz	FM auto	TP-T Sensitivity Max.	L203(4L-935) L201(4L-936) Respectively	Get the maximum point. Repeat 2 or 3 times.
FM-ANT	19 KHz 10% Mod.	98 MHz	FM auto	TP-H	L204(4L-934)	Get the maximum point.
Adjust the 19KHz Modulation from 0 to 10% to check the on-off action of stereo indication circuit.						
FM-ANT	1000 Hz Ch. L only	98 MHz	FM auto	Across Ch. L Output Load	L203(Readjust 4L-935)	Get the maximum output point.

Note: FM ST. Signal Generator output level shall be 60 dB.

SCHEMATIC DIAGRAM



REF. NO.	PART NO.	DESCRIPTION	PART NAME

MISCELLANEOUS

	11022709	Cabinet	2CAB-769
	11062524	Plate, Front	PANEL-769
	11082214	Knob, Tuning	8K-214
	11082279	Knob, Control	8K-279
	11082280	Knob, Band Selector	8K-280
	1192393853	Cover, Cabinet Back	URAITA-767
	11202505	Pointer, Dial	SISIN-769
	11212516	Dial	DIAL-769
	11232493	Plate, Dial Backgrownd	DIAL-P-769
	1142205150	Metal, Dial Plate Retaining	DIAL-A-767
	1134220701		IND-B-546
	11622059	Cover, Pilot Lamp (Red)	PL-DEC-COV
	1330201151	Metal, Heat Sink	HON-P-769
	1320297100	Socket, DIN	SO-971
	1320231500	Socket, AC	SO-315
	1320298900	Socket, 4 pins RCA	SO-989
	1320298300	Socket 6 pins, RCA	SO-983
	1320222500	Socket, Pilot	SO-225
	1320299500	Socket, Power Voltage Selector	SO-995
	1321223300	Terminal, 2 Scrics	T-233
	1321231300	Terminal, 3 Scrics	T-313
	1351250600	Pulley	P-506
	1352247551	Shaft, Dial Cord Drive	DS-475
	1192394354	Cabinet, Bottom	SOKOITA
	1353241800	Drum, Dial Cord Drive	DP-418
	1385551750	Spring, Dial Cord Retaining	SPRING
	1590254700	Lamp, Band Selector	PL-547
PL2,3,4,5	1590255500	Lamp, Pilot	PL-555
	1324292300	Holder, Fuse, AC	FH-923
	1324211300	Holder, Fuse	FH-113
J1	1530222100	Jack, Head Phone	J-221
S1	1531266500	Switch, Power	6S-65
S3 a~c	1531234100	Switch, Band Select	3S-41
	1590231100	Fuse, 1.2A	FUSE-1.2A
	1590232500	Fuse, 1.8A	FUSE-1.8A
	1590275501	Meter, Tuning	METER-755
S4 a~b	15312009	Switch, Mode	OS-09
S5 a~b	15312009	Switch, Tape monitor	OS-09
S6 a~b	15312009	Switch, Loudness	OS-09
S7 a~b	15312009	Switch, Low cut Filter	OS-09
S8 a~b	15312009	Switch, High cut Filter	OS-09
S9 a~b	15312009	Switch, Speaker	OS-09
S10	15312009	Switch, AFC	OS-09
S11	15312009	Switch, Muting	OS-09
	2150244932	Leg, Rubber	GOMULEG 449
	1320292800	Socket, 1 Pin	SO-928
	1351207351	Shaft, Pulley	P-SHAFT
	1590255100	Lamp, (GREEN)	PL-551
S2 a~b	1531240402	Switch, Cartridge Selector	4S-4
	1351250451	Shaft, Pulley	P-504
	1586220770	Cord, AC	ACC-207
	1586222170		ACC-221
	1586226460		ACC-264
	1586226970		ACC-269
	1586227490		ACC-274
	1586229700		ACC-297
	1565253900	FM Tuner, Ass'y	FMT-539
	1577222300	RF Unit, Ass'y	RFU-223
	1577231800	Main-amp Unit, Ass'y	AFU-318
	1577293700	Pre-amp Unit, Ass'y	PAU-937
	1577293900	Tone Unit Ass'y	TONE-UNIT
	1560217400	Variable Tuning with Trimmer	VC-174
	1560283900	Trimmer, FM OSC.	TO-839

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REF. NO.	PART NO.	DESCRIPTION	PART NAME
C621, C622	1557230350	3MFD, 120V, Electrolytic	CT-12-303R
C623, C624, C701	1552608500	.03MFD, 75V, Discap	D-7.5-305
C702, C703	1552210592	.01MFD, 500V, 20%, Discap	D-50-105M
C704	1654617900	2200MFD, 80V	80LASN 2200
C705	1557247117	470MFD, 50V, Electrolytic	CT-5-471X
C706	1557210127	100MFD, 50V, Electrolytic	CT-5-101U
C707	1557250215	50MFD, 15V, Electrolytic	CT1.5-502U
C708, C709	1654617500	2200MFD, 50V, Electrolytic	5L-220QB
C710, C711	1552250727	500PFD, 50V, 10%, Discap	D-5-507K
C714, C715	1556250627	.005MFD, 50V, 10%, Mylar	ML-5-506K
C716	1555210583	.01MFD, 600V, 10%, Oil	OL-60-105K
C717, C718	1556230527	.03MFD, 50V, 10%, Mylar	ML-5-305K

CONTROLS

R511A, B	1548264300	50K ohm, Balance	8V-643
R512A, B	1548263200	50K ohm, Pot., Volume Control	8V-632
R513A, B	1548263400	50K ohm, Pot., Bass Control	8V-634
R514A, B	1548263400	50K ohm, Pot., Treble Control	8V-634
R639, R640	1548272300	50K ohm, Main Control (L and R)	8V-723
R641, R642	1548263600	500 ohm, Main Control (L and R)	8V-636

COILS AND TRANSFORMERS

L1	1504215800	Coil, FM Antenna	4L-158A
L2	1504251700	Coil, FM RF	4L-517C
L3	1504233800	Coil, FM OSC	4L-338B
L4	1504294000	Coil, FM Choke	4L-940
L201	1504293600	Coil, 19KC Amplifier	4L-936
L202	1504293700	Coil, 67KHz SCA Trap	4L-937
L203	1504293500	Coil, 19KHz	4L-935
L204	1504293400	Coil, 38KHz Detector	4L-934
L301	1507205400	Coil, AM OSC	7L-054B
L601	1504215600	Coil, AM Antenna	4L-156A
T1	1504278900	Transformer, 1st FM IF	4IF-789
T101	1504279000	Transformer, 2nd FM IF	4IF-790
T102	1504279100	Transformer, 3rd FM IF	4IF-791
T103	1504277100	Transformer, FM IF Det	4IF-771
T301	1504279200	Transformer, 1st AM IF	4IF-792
T302	1504279300	Transformer, 2nd AM IF	4IF-793
T303	1504276500	Transformer, 3rd AM IF	4IF-765
T701	1515255200	Transformer, Power	5T-552

SEMICONDUCTORS

Q1	1522222720	Transistor, FM RF Amplifier	2SC 535Ⓑ
Q2	1522222710	Transistor, FM Mixer	2SC 535Ⓐ
Q3	1522222720	Transistor, FM OSC	2SC 535Ⓑ
Q4	1522228320	Transistor, 1st FM IF Amplifier	2SC 460Ⓑ
Q5	1522228320	Transistor, 2nd FM IF Amplifier	2SC 460Ⓑ
Q6	1522228330	Transistor, 3rd FM IF Amplifier	2SC 460Ⓒ
Q7	1522225903	Transistor, AM RF Amplifier	2SC 380Ⓓ
Q8	1522225903	Transistor, AM Converter	2SC 380Ⓓ
Q9	1522220920	Transistor, 1st AM IF Amplifier	2SC 454Ⓑ
Q10	1522220910	Transistor, 2nd AM IF Amplifier	2SC 454Ⓐ
Q11	1522220320	Transistor, FM MPX Composite Amplifier	2SC 281Ⓑ
Q12	1522220320	Transistor, MPX 19KHz Ampilfier	2SC 281Ⓑ
Q13	1522220320	Transistor, FM MPX 38KHz Amplifier	2SC 281Ⓑ
Q14, Q15	1522220330	Transistor, FM MPX Indicator	2SC 281Ⓒ
Q16, Q17	1522227705	Transistor, Equalizer Amplifier	2SC 369Ⓡ
Q18, Q19, Q20, Q21	1522224709	Transistor, Equalizer Amplifier	2SC 373Ⓦ
Q22, Q23	1522227705	Transistor, Pre-amplifier	2SC 369Ⓡ
Q24, Q25	1522224709	Transistor, Pre-amplifier	2SC 373Ⓦ
Q26, Q27	1522224709	Transistor, Audio Amplifier	2SC 373Ⓦ
Q28, Q29	1522229503	Transistor, Driver Amplifier	2SC 734Ⓞ
Q30, Q31	1522230504	Transistor, Driver Amplifier	2SC 485Ⓨ
Q32, Q33	1522230304	Transistor, Driver Amplifier	2SA 485Ⓨ
Q34, Q35, Q36, Q37	1522230100	Transistor, Power Amplifier	2SD-92
Q38	1522229504	Transistor, Ripple Filter	2SC 734Ⓨ
Q39	1522220330	Transistor, Tuning Meter	2SC 281Ⓒ
Q40	1522220330	Transistor, Muting	2SC 281Ⓒ
D1, D2	1522270208	Diode, FM Detector (Matched pair)	1N60Ⓟ
D3	1522270200	Diode, FM AGC	1N60
D4	1522270200	Diode, FM Limitter	1N60
D5	1522270200	Diode, AM Detector	1N60
D6	1522279100	Diode, AM AGC	M8513Ⓡ
D7	1522270200	Diode, Tuning Meter	1N60
D8	1522279100	Diode, Voltage Stabilizer	M8513Ⓡ
D9	1522270100	Diode, FM MPX	1N34A
D10, D11	1522270100	Diode, Frequency Doubler	1N34A
D12, D13, D14, D15	1522270100	Diode, FM MPX Detector	1N34A
D16	1522273700	Diode, FM AFC	SI-RECT-23
D17	1522279500	Diode, Zener	SI-RECT-47
D18, D19	1522276500	Diode, Power Rectifier	SI-RECT-39
D20	1522275900	Diode, Power Rectifier	SI-RECT-33
D21, D22	1522279700	Diode, thermal Control	SI-RECT-45
D23, D24	1522279100	Diode, Voltage Stabilizer	M8513

PACKAGED CIRCUITS

M101, M102	1559233200	Capristor	PRC-332
M103	1559230600	Capristor	PRC-306
M201, M202	1559237100	Capristor	PRC-371